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ANT COMMUNITY OF AN *Acacia mangium* FOREST IN INDONESIAN BORNEO

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ABSTRACT

The exotic timber tree *Acacia mangium* often colonizes areas of Borneo where native forests have been cleared for agriculture. To assess the biodiversity value of this novel habitat, we surveyed the ant community of a naturalized *A. mangium* forest on the border of Gunung Palung National Park in West Kalimantan, Indonesia. We documented 33 species from 18 genera and four subfamilies. The invasive yellow crazy ant (*Anoplolepis gracilipes*) dominated the assemblage, making up 85% of pitfall trapped individuals and 28% of those sifted from leaf litter. Nevertheless, *A. mangium* forest harbored fewer invasive species than nearby urban land, and may serve as an effective buffer around protected areas.

Keywords: Biodiversity, Formicidae, Gunung Palung National Park

ABSTRAK

Pokok kayu eksotik *Acacia mangium* sering mengkolonisasi kawasan Borneo di mana hutan asli dibersihkan untuk kepentingan pertanian. Untuk menilai kepelbagaian habitat baru ini, kami meninjau komuniti semut hutan *A. mangium* yang semula jadi di sempadan Taman Negara Gunung Palung, Kalimantan Barat, Indonesia. Kami merekodkan 33 spesies dari 18 genus dan empat subfamili. Semut antik kuning (*Anoplolepis gracilipes*) infasif dikuasai komuniti, membentuk 85% perangkap yang terperangkap dan 28% yang ditapis dari sampah daun. Walau bagaimanapun, hutan *A. mangium* mempunyai spesies invasif yang lebih sedikit daripada tanah perkampungan yang berdekatan, dan boleh menjadi penimbal yang berkesan di sekitar kawasan perlindungan.

Kata kunci: Kepelbagaian, Formicidae, Taman Negara Gunung Palung

INTRODUCTION

The island of Borneo contains the largest remaining rainforest in Asia and is home to thousands of endemic species (Corlett 2014). Its forests, however, are being cleared at an alarming rate and over half the island has been converted to oil palm plantations (Donald 2004), croplands (e.g. Zamzani et al. 2009) and timber plantations (National Research Council 1983). *Acacia mangium* (Willd., 1806, Fabaceae), introduced from northern Australia, is one of the most popular timber species in Borneo, and is considered invasive because it rapidly dominates disturbed areas, alters soil chemistry and leaf litter deposition (Pellens & Garay 1999; Yamashita et al. 2008), and supports lower animal diversity and abundance than do native forests (Tsukamoto & Sabang 2005; Mang & Brodie 2015). At the same time, *A. mangium* forests harbor more native forest species than do anthropogenic grasslands or farmland

(Matsumoto et al. 2015; Ueda et al. 2015) and perform some of the ecosystem functions of native secondary forest (Yamashita et al. 2008). To the extent that *A. mangium* forests replace anthropogenic habitats rather than native forest, they may thus benefit native biodiversity.

We address this issue by studying the ant community of a naturalized *A. mangium* forest on the border of Gunung Palung National Park, a 108, 000 hectare protected area in West Kalimantan, Indonesia. The park is impacted by illegal logging and agroforestry (Curran et al. 2004; Zamzani et al. 2009), and disturbed areas along its edge are often dominated by naturalized forests of *A. mangium*. Ants are an ideal taxon for biomonitoring studies because they contribute to many ecosystem functions and their diversity is correlated with that of other organisms (Folgarait 1998; Agosti et al. 2000). Our survey is a preliminary part of an ongoing study to evaluate reforestation and conservation in disturbed landscapes in Borneo.

MATERIALS AND METHODS

The study site consisted of 0.5 hectares of private land in Sukadana, West Kalimantan, Indonesia (1°15'9.00"S, 109°57'53.28"E, Fig. 1). It had been used for farms or plantations until it was cleared by a wildfire in 2006. By 2017 it had regenerated to secondary forest with an open *A. mangium* canopy (<20 m tall) and an understory of grasses, herbaceous vegetation, small palms (<2 m), and native rainforest seedlings (< 4 m) including *Macaranga* and *Shorea* species. The plot was bounded to the south by more *A. mangium* forest, to the west by a farm and urban land, to the north by a jungle rubber plantation, and to the east by a timber plantation (*Neolamarckia cadamba*, <3 years old) and Gunung Palung National Park.

We surveyed the plot during the wet season from 18 to 23 January 2017 using pitfall traps, litter sifting, log dissections and

hand collecting (Agosti et al. 2000). We placed 10 pitfall traps spaced 10 meters apart along a 100 meter transect through the plot for ~48 hours. Traps were 8.5 cm diameter plastic cups filled with 96% isopropyl alcohol and some detergent to break surface tension. After pitfall trapping we collected leaf litter and fallen wood from a 1-m^2 plot at each pitfall location, sifted it over 0.7 cm mesh, and collected any ants that fell through. We also sampled a fallen log 1 to 5 meters from each pitfall trap. We searched for ants on the log's surface and under the bark, then cut it into sections and collected ants found inside. Finally, we collected ants by hand from the 0.5 ha plot for ~2 person-hours.

Specimens were identified or assigned to morphospecies using resources available at AntWeb (AntWeb 2017), AntWiki (AntWiki 2017), and keys and monographs (Smith 1857; Emery 1925; Brown 1976; Bolton 1977, 1979, 2000, 2007; Eguchi 2001; Yamane 2007; Kohout 2008; Hosoishi & Ogata 2009; Fayle et al. 2014; Schmidt & Shattuck 2014; Xu & He 2015). Voucher specimens are stored in the laboratory of Yayasan Alam Sehat Lestari in Sukadana, West Kalimantan, Indonesia. Normal data are presented as means with standard deviations, and non-normal data as medians with interquartile ranges. To check if sampling had gone to completion and to estimate total species richness, we used Chao2 sample-based rarefaction derived from 100 randomizations in the program EstimateS 9.1.0 (Colwell 2013).

RESULTS AND DISCUSSION

We collected 33 ant species from 18 genera and 4 subfamilies (Table 1). Pitfall traps captured 296 individuals of 17 species and litter sifting 114 individuals of 10 species. Log dissections yielded 7 species and hand collecting 20. Pitfall traps averaged 29.6 ±14.6 individuals and 3.6 ±1.5 species per trap. Litter sifting yielded a median of 4 individuals (interquartile range 0.25 to 17) and mean of 2 ±2.1 species per plot. Species richness estimates suggest that pitfall sampling approached completion, but estimates for litter

sampling failed to level off and would likely increase with further sampling. Both estimates (23.1 ±5.4 species for pitfalls and 28.9 ±15.5 for litter), however, approach the observed richness obtained from all methods combined (33 species). This species richness is comparable to nearby agroforestry landscapes (e.g. Rubiana et al. 2015), and below the 100 to 200 species expected in primary forest (Woodcock et al. 2011).

The invasive yellow crazy ant, *Anoplolepis gracilipes* (Wetterer 2005), was collected by all methods and in every pitfall trap, and made up 85% of pitfall and 28% of litter specimens. A second invasive—Alluaud's little yellow ant, *Plagiolepis alluaudi* (Wetterer 2013)—also occurred but was not common, with three individuals from two pitfall traps. The site lacked several invasive or tramp species that occurred nearby. *Paratrechina longicornis* (Latreille, 1802), *Platythyrea parallela* (F. Smith, 1859) and *Tapinoma melanocephalum* (Fabricius, 1793), for example, were common in urban areas 400 meters away, and *Solenopsis geminata* (Fabricius, 1804) occurred in farmland up to the forest edge (unpublished collections by authors), but none of these species were collected within the forest. Naturalized *A. mangium* forests on degraded lands may thus benefit some native biodiversity and serve as an effective buffer around protected areas.

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Table 1. Ants of *Acacia mangium* forest in West Kalimantan, Indonesia.

Subfamily	Species	Collecting method
Dolichoderinae	*Dolichoderus thoracicus* (F. Smith, 1860)	Hand
	Technomyrmex horni (Forel, 1912)	Litter
Formicinae	*Anoplolepis gracilipes* (F. Smith, 1857)	Pitfall, Litter, Log, Hand
	Camponotus irritans (F. Smith, 1857)	Pitfall, Litter, Log, Hand
	Camponotus sp1	Log, Hand
	Camponotus (Tanaemyrmex) sp2	Pitfall, Hand
	Nylanderia kraepelini (Forel, 1905)	Pitfall, Litter, Log
	Nylanderia obscura (Mayr, 1862)	Pitfall, Hand
	Nylanderia cf. vaga	Pitfall, Litter
	Oecophylla smaragdina (Fabricius, 1775)	Hand
	Plagiolepis alluaudi (Emery, 1894)	Pitfall
	Polyrhachis abdominalis (F. Smith, 1858)	Hand
	Polyrhachis inermis (F. Smith, 1858)	Hand
	Polyrhachis pruinosa (Mayr, 1872)	Hand
Myrmicinae	*Carebara sp1*	Litter
	Crematogaster ferrarii (Emery, 1888)	Pitfall, Litter, Log, Hand
	Crematogaster physothorax (Emery, 1889)	Pitfall, Hand
	Crematogaster sp1	Hand
	Crematogaster sp2	Hand
	Pheidole kikutai (Eguchi, 2001)	Hand
	Pheidole lucioccipitalis (Eguchi, 2001)	Litter
	Pheidole merimbun (Eguchi, 2001)	Hand
	Pheidole plinii (Forel, 1911)	Pitfall, Log

	Pheidole submonticola (Eguchi, 2001)	Litter
	Solenopsis (Diplorhoptrum) sp1	Pitfall
	Strumigenys godeffroyi (Mayr, 1866)	Log
	Tetramorium adelphon (Bolton, 1979)	Pitfall
	Tetramorium eleates (Forel, 1913)	Litter
Ponerinae	*Brachyponera luteipes* (Mayr, 1862)	Pitfall, Hand
	Diacamma rugosum (Le Guillou, 1842)	Pitfall, Hand
	Leptogenys peuqueti (Andre, 1887)	Pitfall, Hand
	Odontomachus rixosus (F. Smith, 1857)	Pitfall
	Odontomachus simillimus (F. Smith, 1858)	Pitfall, Hand

Figures

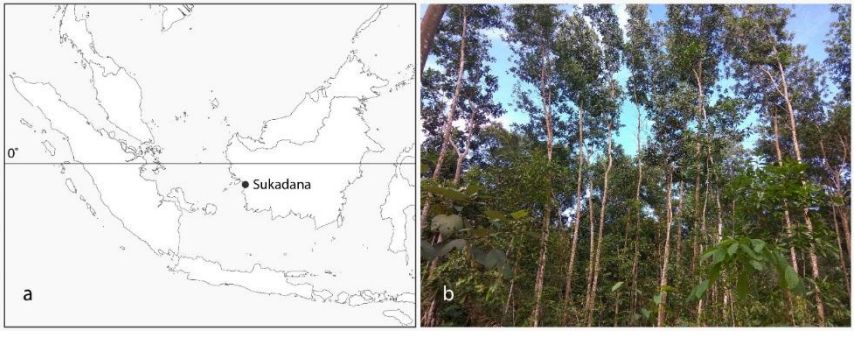

Figure 1. Our study site in Sukadana, West Kalimantan, Indonesia (a, black circle) was in young invasive *Acacia mangium* forest (b) that developed after the previous vegetation

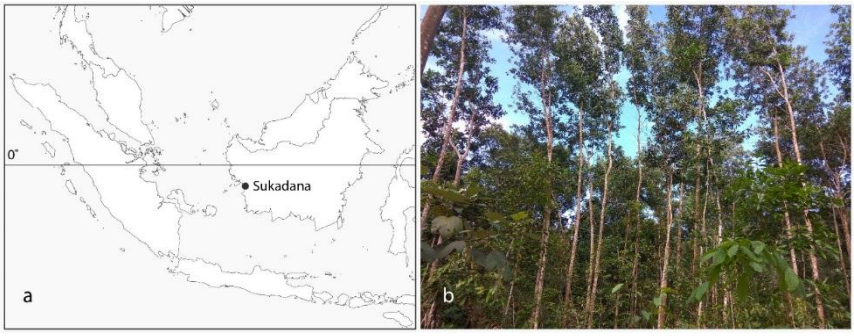

Figure 2. Our study site in Sukadana, West Kalimantan, Indonesia (a, black circle) was in young invasive *Acacia mangium* forest (b) that developed after the previous vegetation was cleared by fire